



NOAA
FISHERIES

SWFSC-FRD

Overview of CPS Assessments & Data

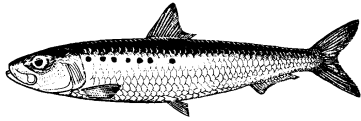
Kevin T. Hill

Population Dynamics Group

Presentation 5.0

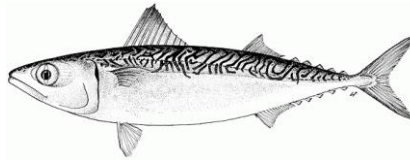
July 29, 2013

CPS Assessment Status & Cycles



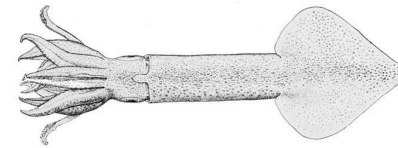
Pacific Sardine

- Actively managed
- Assessed annually
- Benchmark every 2nd yr and update in interim years



Pacific Mackerel

- Actively managed
- Assessed annually
- Benchmark every 3rd yr
- Update in interim years
- Low-volume fishery currently
- Future: benchmark every 4th yr and update every 2nd yr



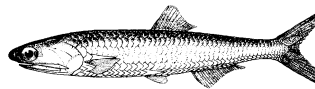
Market Squid

- Monitored in federal FMP
- Actively managed under CA FMP
- Not formally assessed, but stock status research conducted
- High-volume fishery over last decade
- *Egg Escapement Method* (per-recruit analysis) for biological reference points.



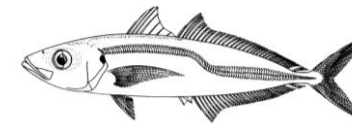
Northern Anchovy Central subpopulation

- Monitored status in FMP
- Low-volume fishery currently
- Last assessed in 1995



Northern Anchovy Northern subpopulation

- Monitored status in FMP
- Low-volume fishery currently
- Never formally assessed



Jack Mackerel

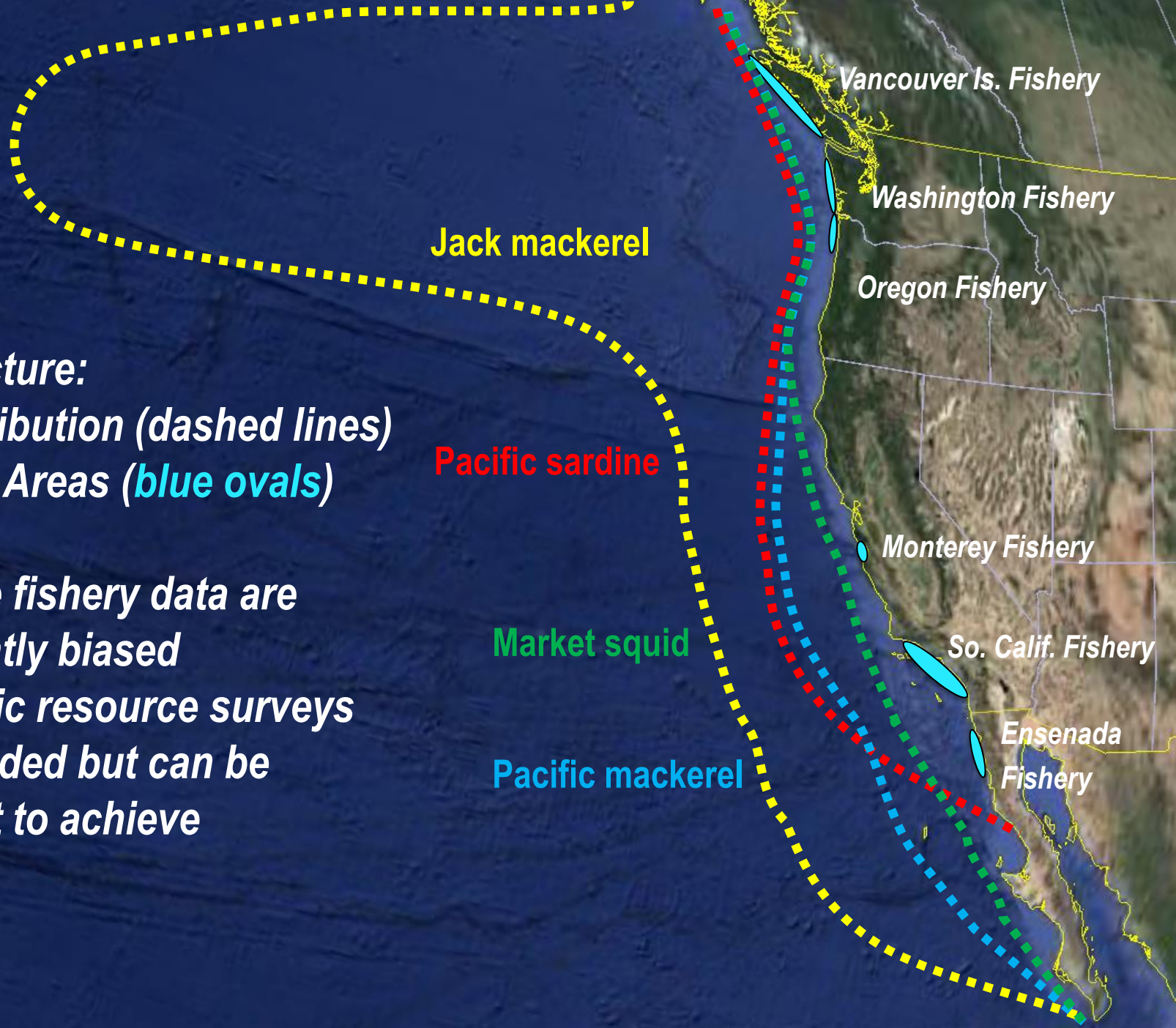
- Monitored status in FMP
- Low-volume fishery currently
- Never formally assessed

CPS Data Available:

- Fishery-dependent data
 - Catch tonnage, Size, Age, Sex, Maturity, CPFV logbook, RecFIN, Aerial spotter logs (dead)
 - Spatial coverage limited relative to whole population
- Fishery-independent series of abundance
 - SWFSC surveys for eggs and larvae: CalCOFI and Daily Egg Production Method (DEPM)
 - SWFSC Acoustic-trawl method (ATM): spring DEPM & summer SaKe
 - Northwest Sardine Survey (NWSS) – aerial photogrammetry & point sets (summer)
 - Other: NWFSC forage fish surveys (not used), Canadian Trawl (reviewed but not used), IMECOCAL eggs & larvae (not available)
- Models & data for CPS assessment have evolved:
 - Modeling platforms have changed; all based on age-structured approach:
 - Pacific sardine: CANSAR→CANSAR-TAM→ASAP→SS
 - Pacific mackerel: ADEPT→ASAP→SS
 - Fisheries and associated data have changed
 - Survey time series have changed

The Big Picture:
Stock Distribution (dashed lines)
vs. Fishing Areas (blue ovals)

- *Inshore fishery data are inherently biased*
- *Synoptic resource surveys are needed but can be difficult to achieve*

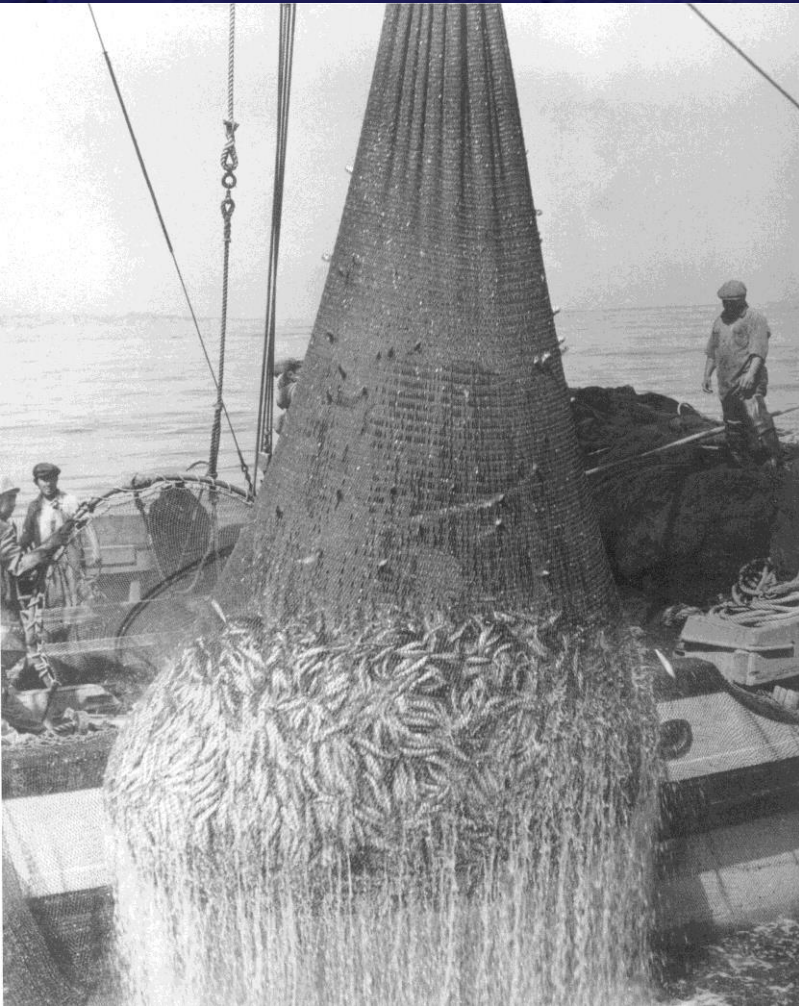


Pacific Sardine: A 'Data Rich' Assessment

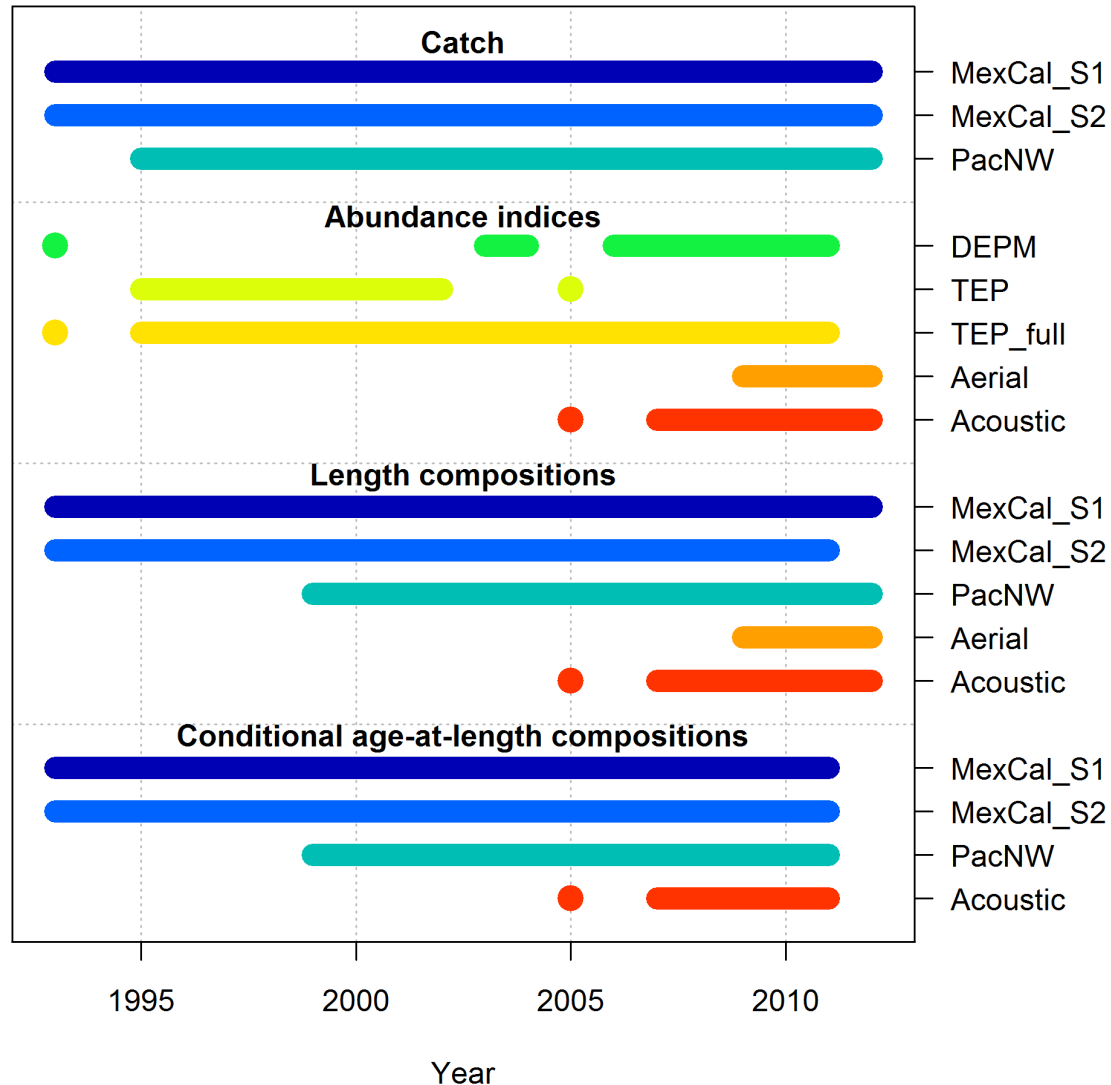
Summer/Fall
Feeding Habitat

Winter/Spring
Spawning Habitat

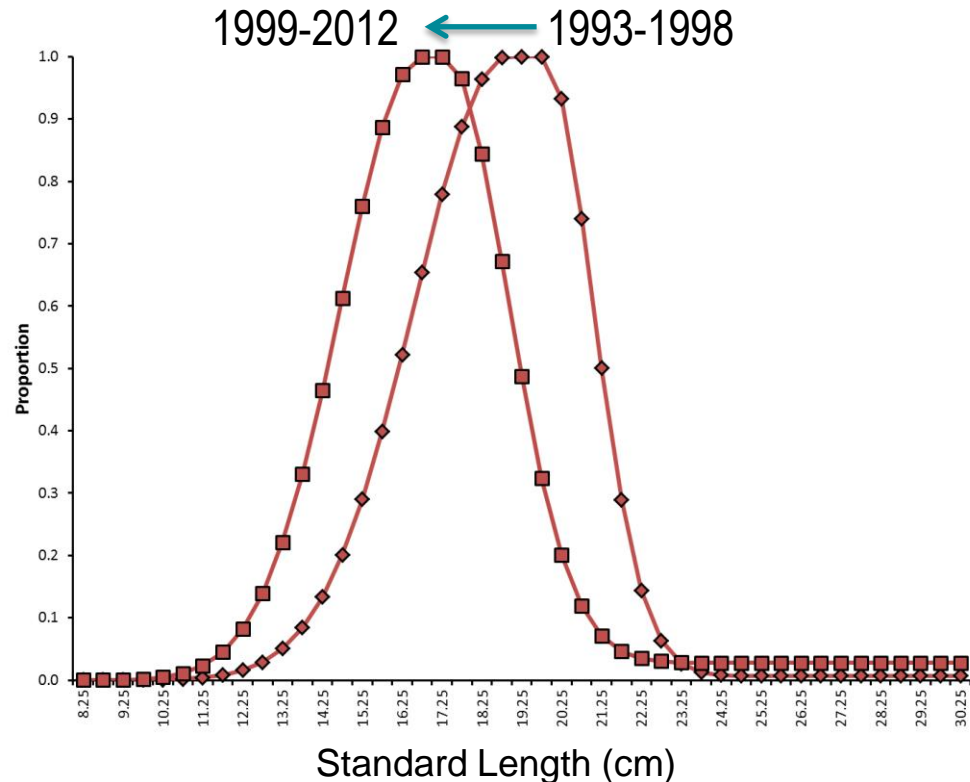
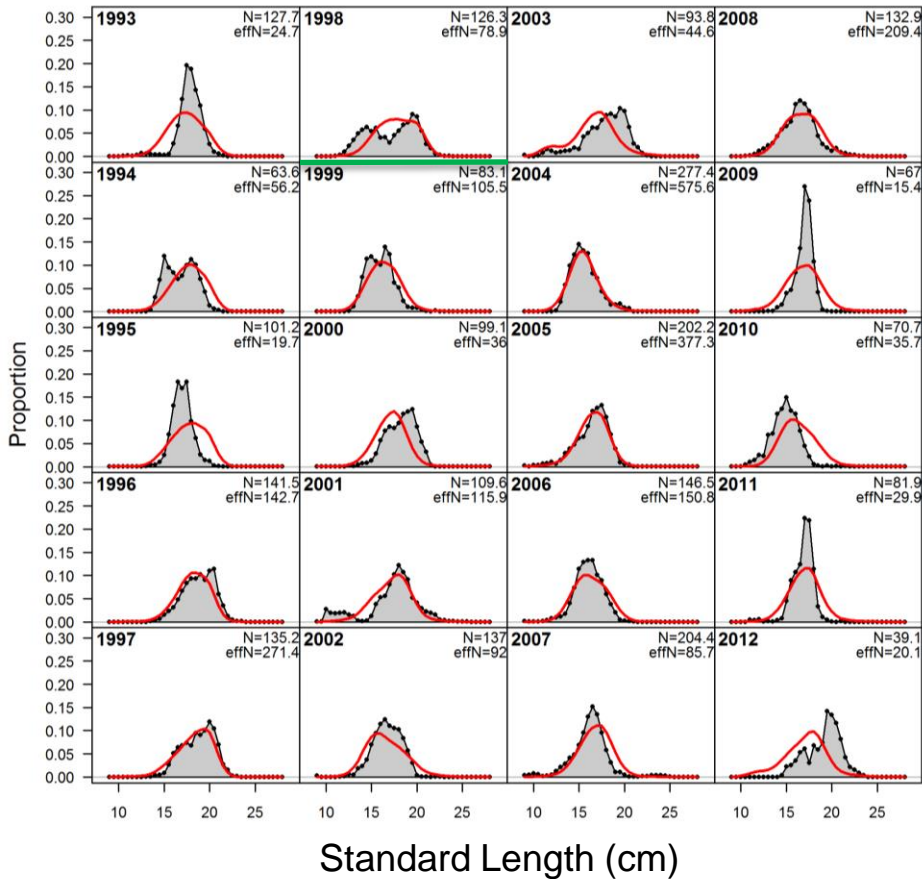
Nursery Habitat



Sardine Assessment Data (Hill et al. 2012)



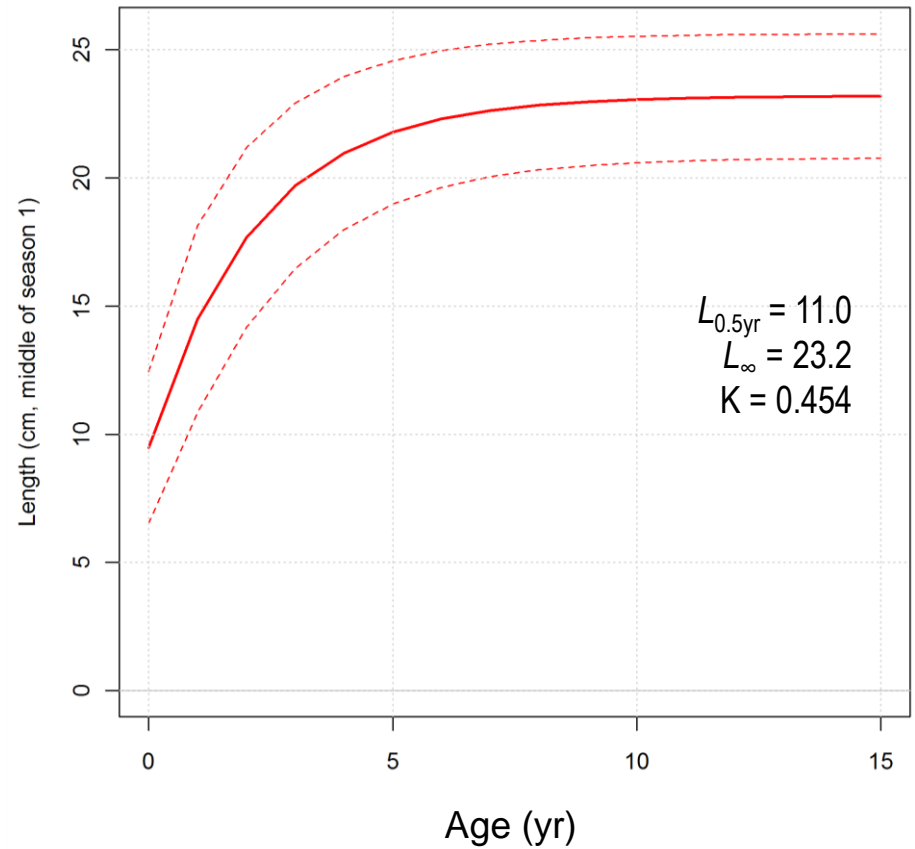
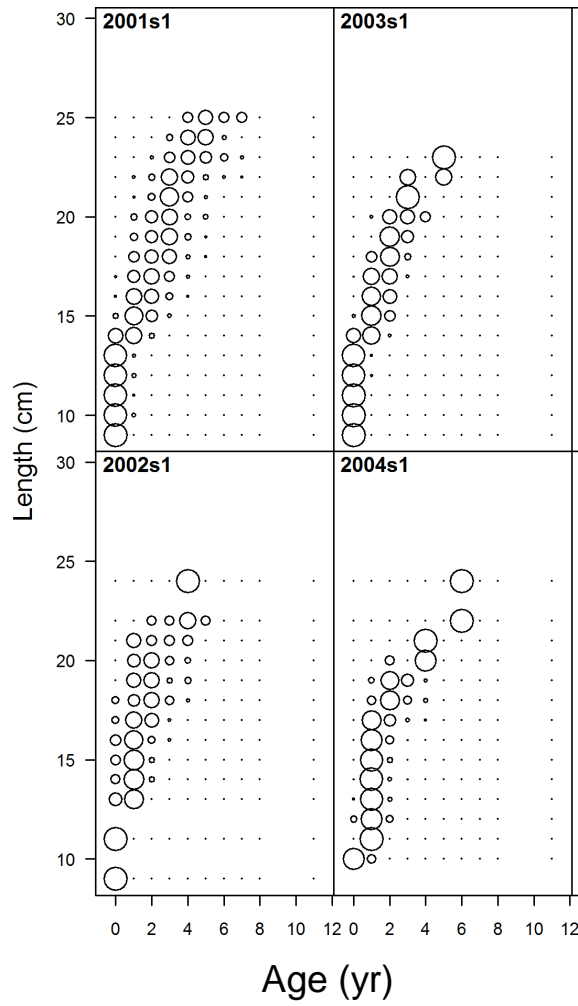
Length Data and Selectivity (MexCal_S1 Fleet)



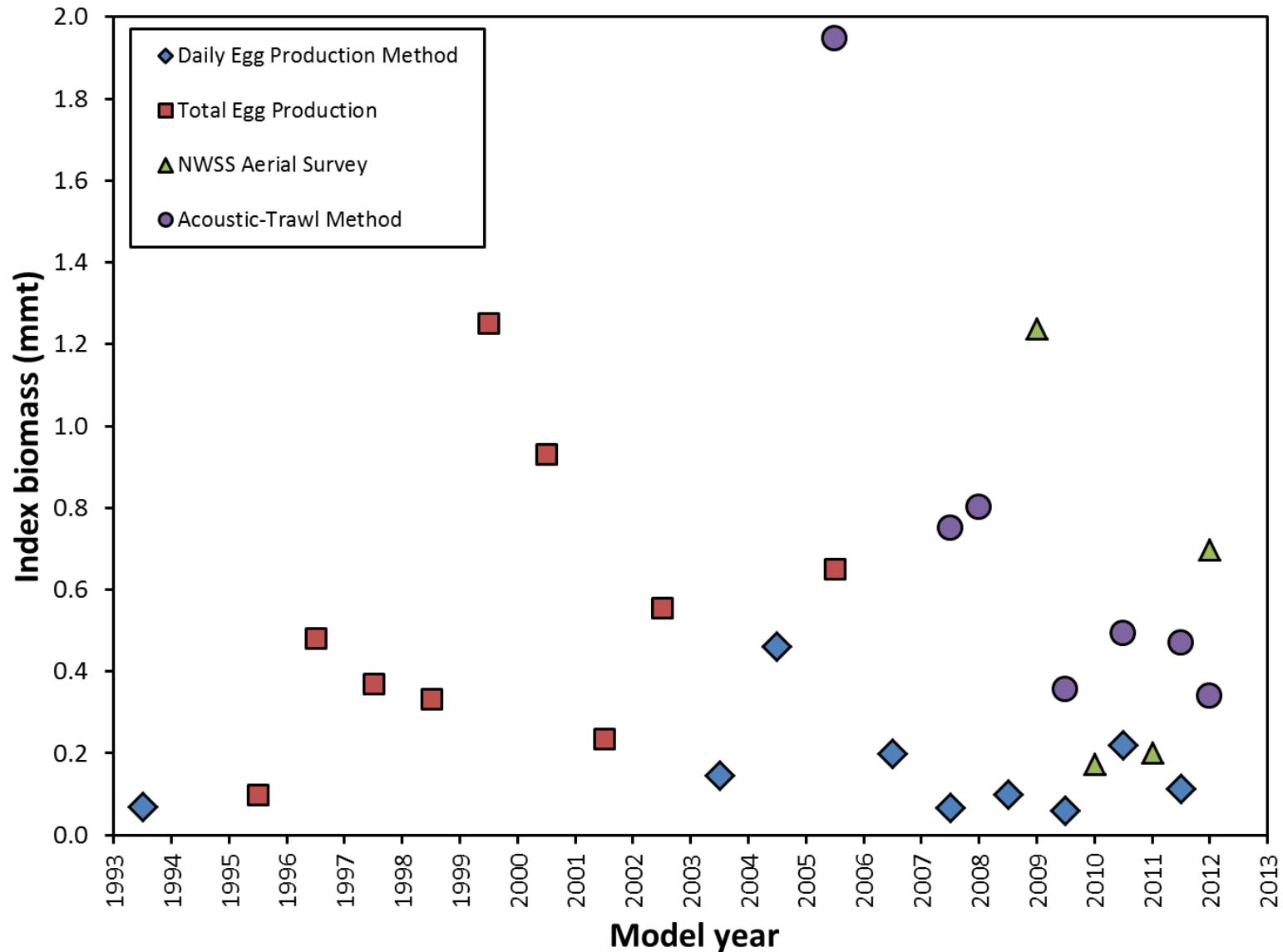
Conditional Age-at-Length



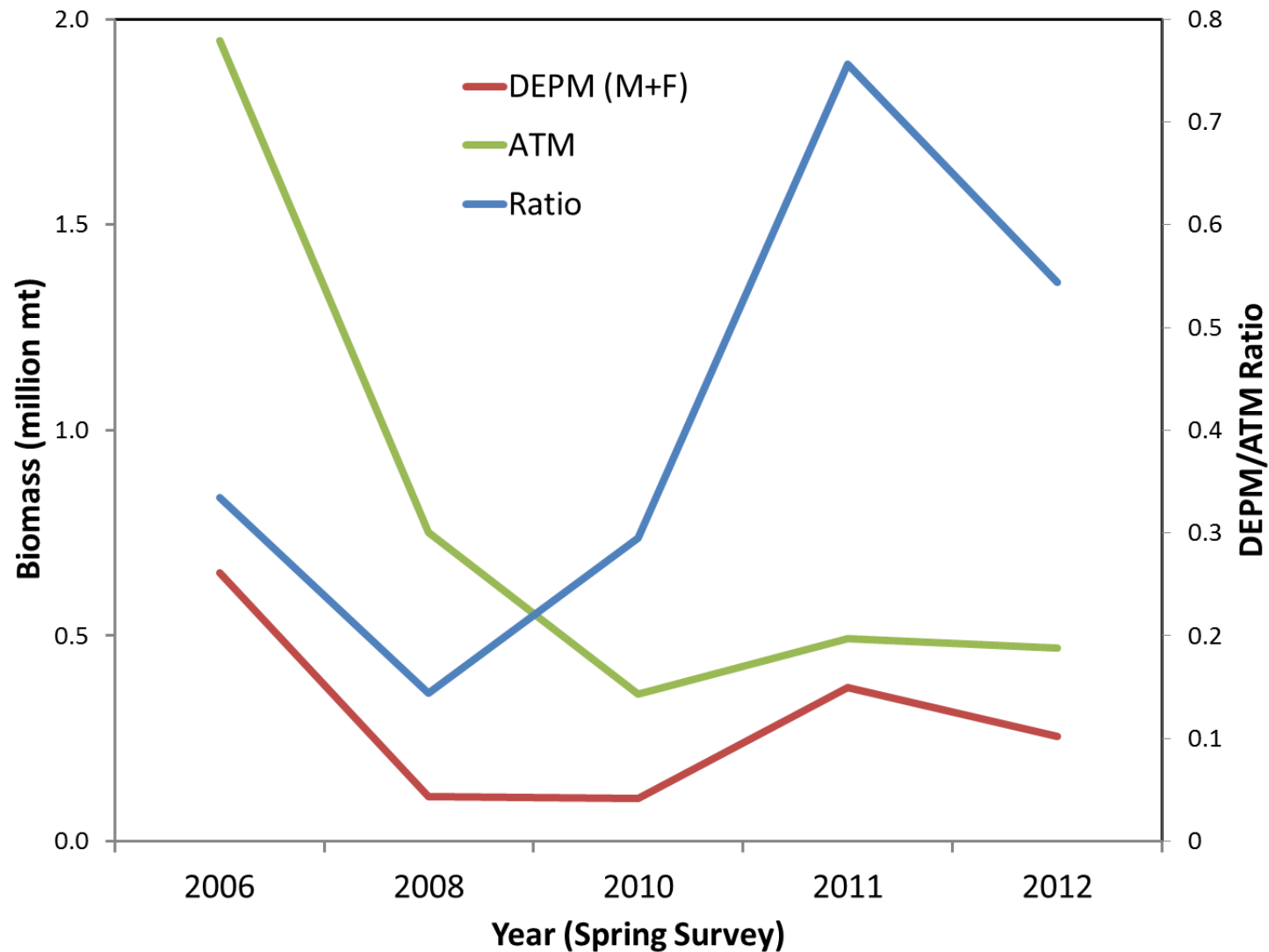
Growth



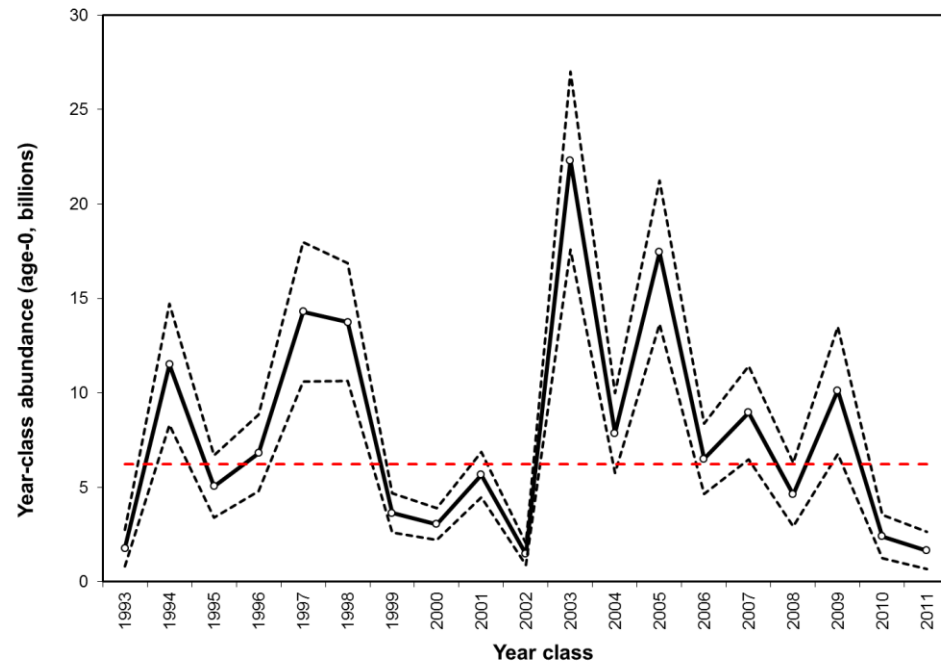
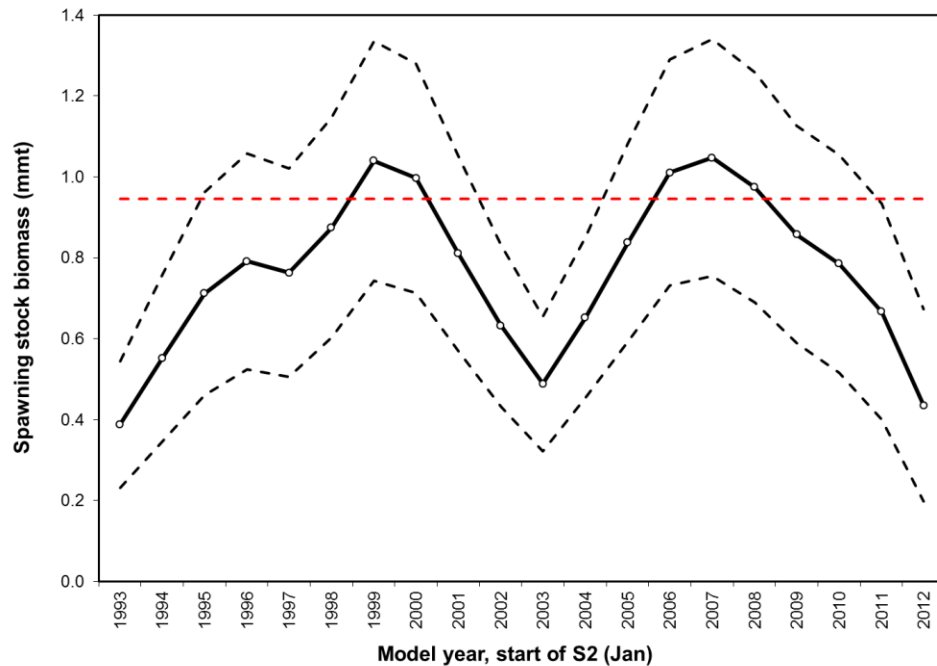
Sardine Assessment Survey Time Series



SWFSC Survey Time Series: DEPM v. ATM



Estimated SSB and Recruitment Time Series



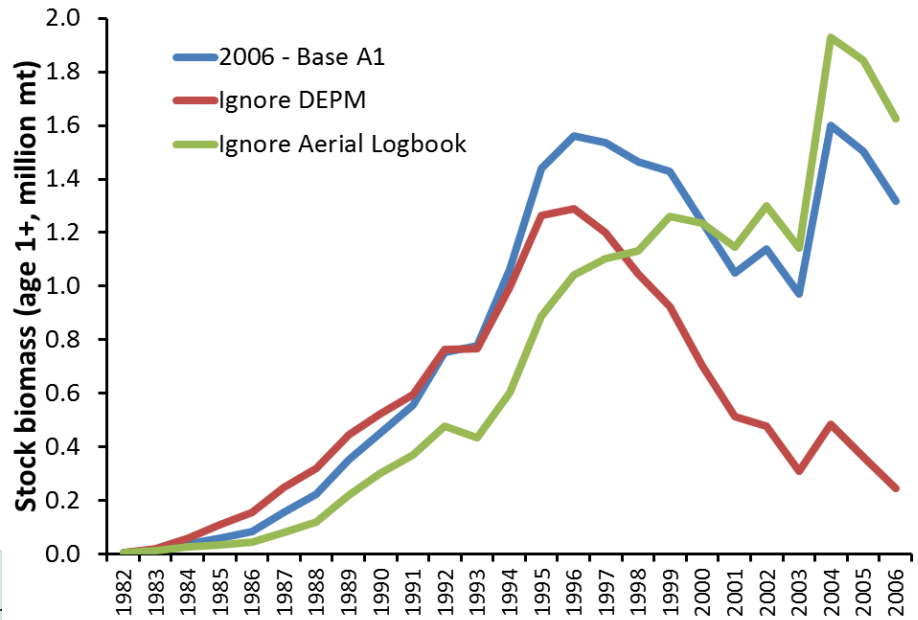
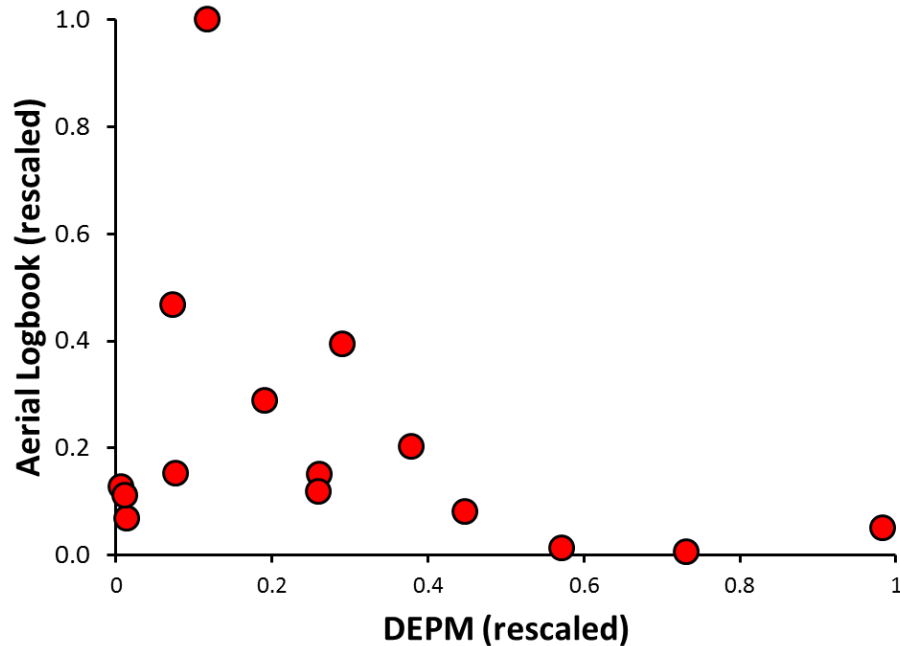
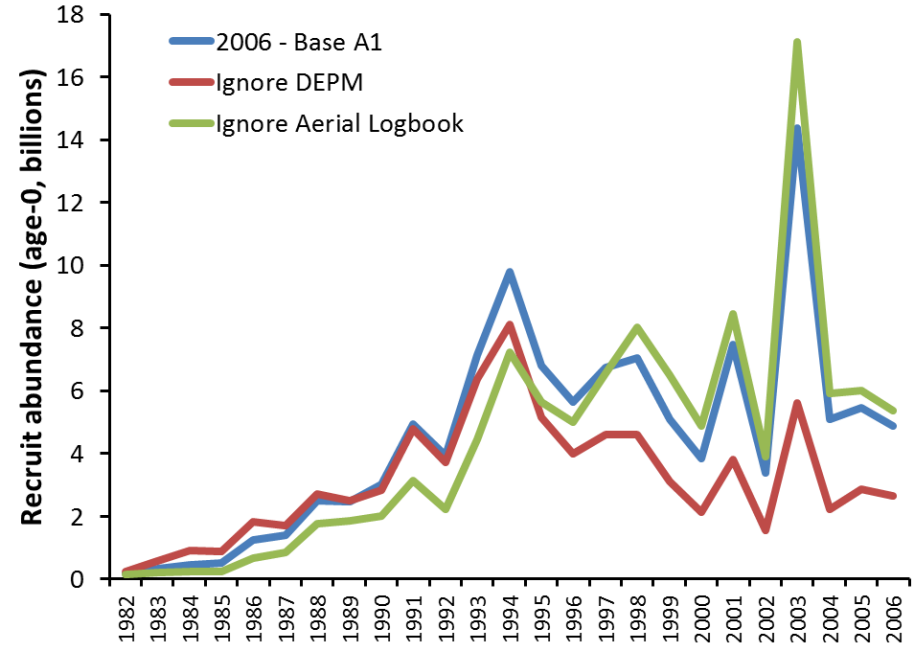
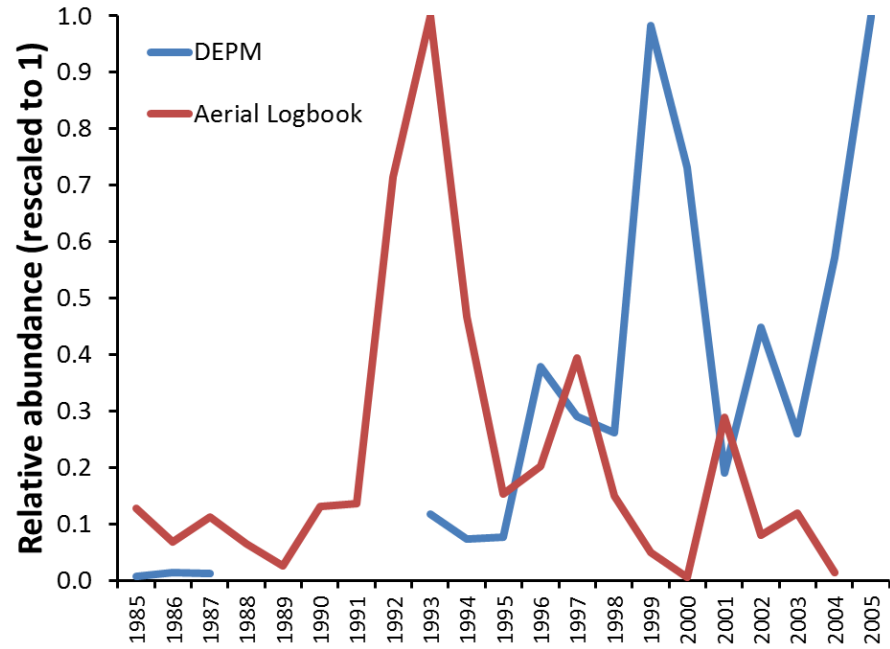
Sardine Assessments

Evolution of Survey Data & Models

SURVEY DATA USED FOR SARDINE ASSESSMENT								
YEAR	MODEL	Daily Egg Production	Total Egg Production	CalCOFI % Positive (Eggs & Larvae)	Spawning Area	Aerial Spotter Logbook	NWSS Aerial Survey	Acoustic Trawl Method
1996	CANSAR							
1997	CANSAR							
1998	CANSAR-TAM							
1999	CANSAR-TAM							
2000	CANSAR-TAM							
2001	CANSAR-TAM							
2002	CANSAR-TAM							
2003	CANSAR-TAM							
2004	ASAP							
2005	ASAP							
2006	ASAP							
2007	SS							
2008	SS							
2009	SS							
2010	SS							
2011	SS							
2012	SS							

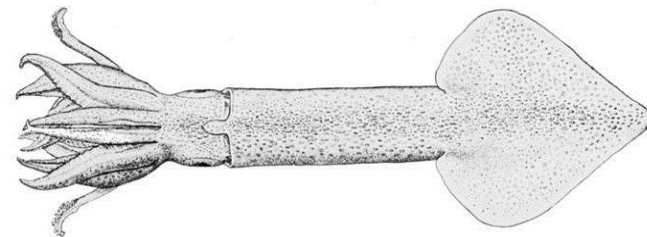


Influence of Past Sardine Assessment Data



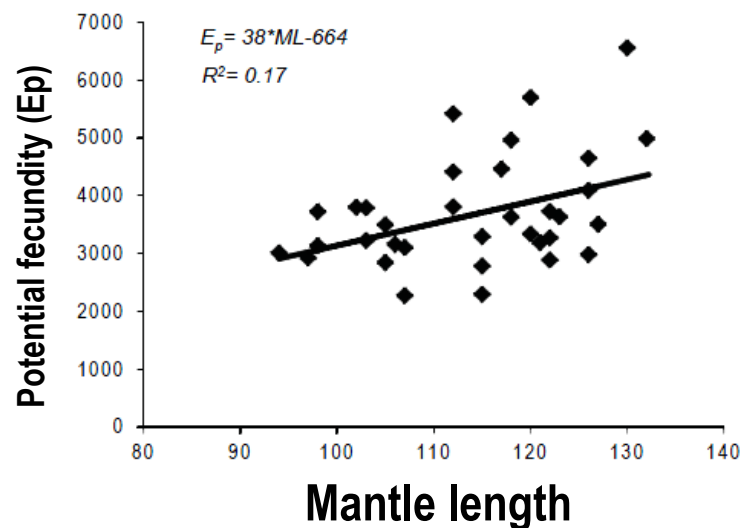
Market Squid Population Dynamics Modeling

- Largest CPS fishery by volume and ex-vessel value
- Not regularly 'assessed' for setting harvest levels
- Current management includes weekend closures, seasonal landings cap, and *de facto* spawning refugia (MPAs)
- Squid 'STAR Panel' in 2001 resulted in development of the Egg Escapement Method (Macewicz et al. 2004; Maxwell et al. 2005; Dorval et al. 2013) - based on per recruit theory/application



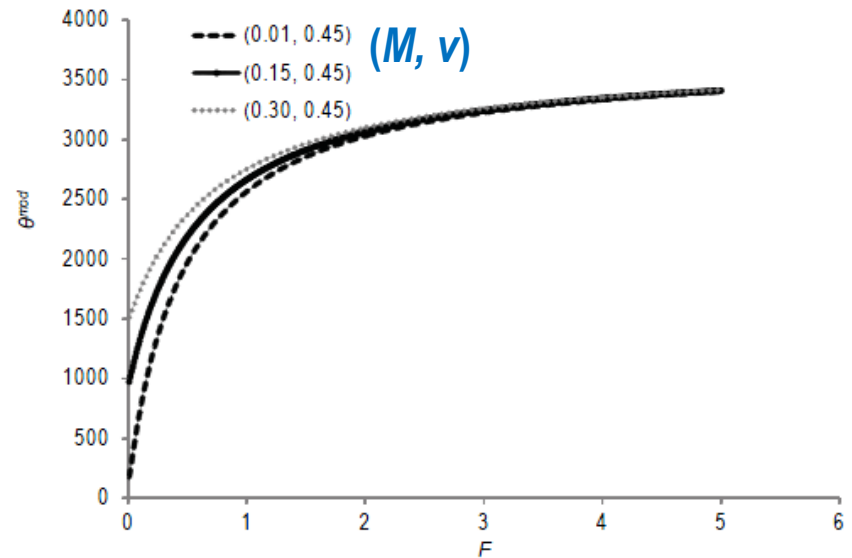
Life History Data for Egg Escapement Method

- Live on average 6 months
- Have determinate (i.e. fixed) fecundity
- Lay egg cases in clutches for approximately 2-3 days, and die after spawning (i.e., semelparous)
- Calculate potential fecundity: standing stock of oocytes of all stages in the ovary of mature pre-ovulatory females
- Fishing on spawning grounds (typically), so calculate lost spawning potential due to fishing



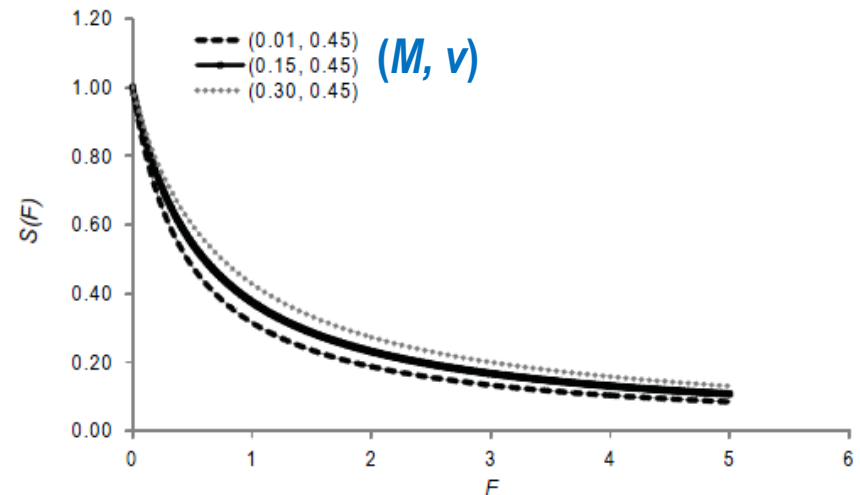
Reproductive and fishery parameters

Catch fecundity:
(Number of oocytes and ova
in the ovaries and oviducts
of harvested females)



Proportional egg escapement:

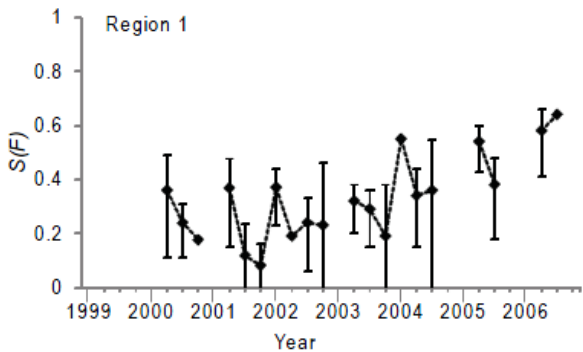
$$S(F) = \frac{EE(F > 0)}{EE(F = 0)}$$



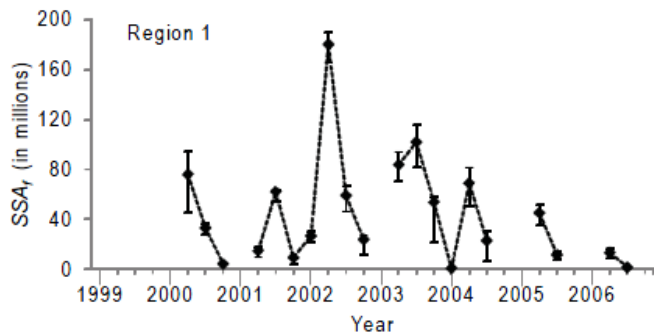
Application of Egg Escapement Method to Fishery Data – Dorval et al. 2013

Monterey Bay

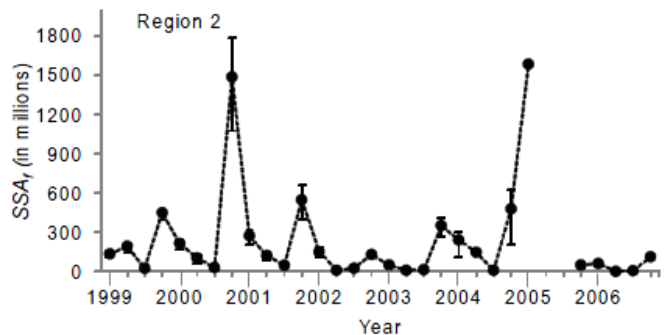
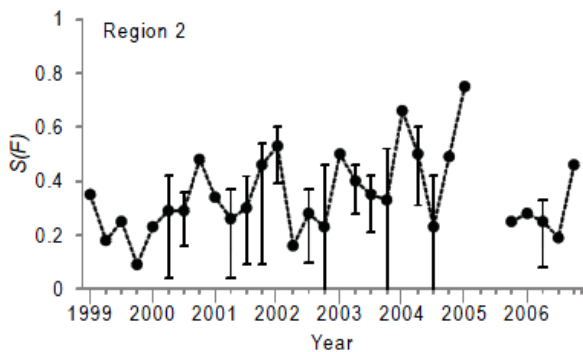
Proportional egg escapement



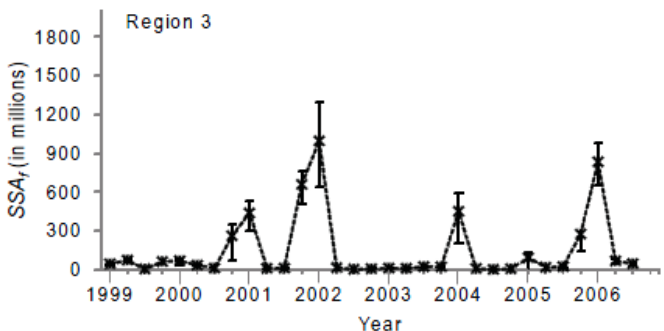
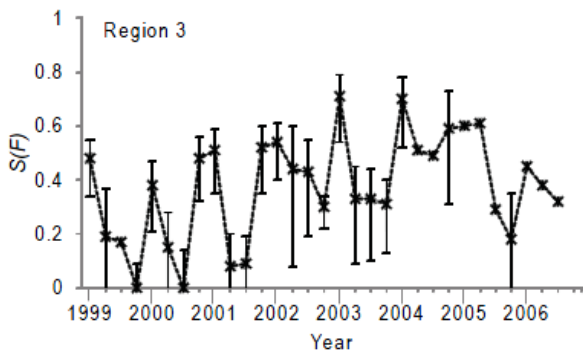
Mean abundance



Northern Channel Islands



Southern Channel Islands



Strengths, Challenges, & Strategies

➤ Strengths

- Longer-term resource surveys (CalCOFI & Spring DEPM)
- Acoustic-Trawl Method (2006 onward)
- Size and quality of surveys has improved over time
- Comprehensive port sampling for intensively-fished CPS

➤ Challenges

- CPS stocks are transboundary:
 - Stock structure questions potentially important but unresolved
 - Ensenada fishery data (biological compositions) difficult to obtain
 - Synoptic surveys can be challenging for stocks straddling U.S.-Mexico border
- Assessments needed for the broader CPS assemblage: anchovy N&C; jack mackerel, squid (update BRPs)
- SWFSC surveys (DEPM & ATM) both rely on trawled adults, but utility of trawl samples differs
 - Aggregate reproductive statistics for large strata vs. apportioning backscatter at local level
- Staffing: currently two 'CPS' assessment scientists for most technical/management/policy issues (e.g., one has led 66% of CPS assessments and served on CPSMT since 1997)
- Data management: multiple types and sources; data collation and reduction very time consuming

➤ Strategies

- Continue evaluating trawl efficiency, catchability, and selectivity using new/existing tools
- Apply advanced acoustic methods (searchlight sonar) to sample 'blind spots' (upper 10m)
- Collaborate with Mexico regarding joint surveys and assessments
- Identify and recruit new assessment staff and data base management staff